WEST Search History

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DATE: Wednesday, February 25, 2004

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☐	L7	19991215	5
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☐	L5	19991215	39
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☐	L3	l1 and (((differential adj3 service) or Diff-serv or (quality adj3 service) or QoS or QOS) near8 priority)	5
☐	L2	l1 and ((differential adj3 service) or Diff-serv)	1
☐	L1	('6014694' |'6490705' |'6587985' |'6587433' |'6188670' |'6633564' |'6661774' |'6320845' |'6147980' |'6125110' |'6205150' |'6526062' |'6549938' |'6577596' |'6185602' |'6104757' |'6360075')!.PN.	17

END OF SEARCH HISTORY

L3: Entry 2 of 5 File: USPT Jun 10, 2003

DOCUMENT-IDENTIFIER: US 6577596 B1
TITLE: Method and apparatus for packet delay reduction using scheduling and header compression

Detailed Description Text (5):
Notwithstanding LFI methods as described above, once packets are fragmented, they may be queued according to, for example, a conventional priority queuing scheme, an example of which is illustrated in FIG. 3, or may be queued according to a suitable derivative thereof. Exemplary network node 300 is shown having a priority queuing implementation with queues 311-314 ranging from Low to High priority respectively. Packets 315, 316, and 317, for example, arrive at network layer 210 with different priorities as may be determined by the contents of, for example, QoS information included with an IP header typically associated with each of packets 315, 316, and 317 respectively. High priority packet 317, for example, may be placed in high priority queue 314 by process 320. Incoming medium priority packet 315 and low priority packet 316 may be placed respectively in medium priority queue 313 and low priority queue 311 by process 320 when arriving at network layer 210. Priority queuing may take place at layer 310 which may be equivalent to data link layer 230 or an alternative protocol layer such as a PPP layer or the like which interfaces with data link layer 230. Outbound packets 318a-318d are sent to process 231 for queuing in transmit queue 232 according to priority with high priority outbound packet 318a being sent first as shown. Outbound packets 318a-318d may then be transferred to the physical layer by process 231 which may be a typical data link process such as HDLC or the like where they can be processed in FIFO transmit queue 232 and output to physical link 233.

Detailed Description Text (8):
Therefore in accordance with one embodiment of the present invention, as illustrated in FIG. 5A, for example, various QoS levels which may be specified in an IP header of a datagram bound for IP layer 510 may be handled by performing "pure" IP scheduling at IP layer 510. It can be seen that a queuing discipline may be invoked using queues 512-514 for handling time sensitive packets. Lowest time sensitivity queue D.sub.N-1 512 my carry packets with the longest delay tolerance. It may be possible for such time sensitivity to be determined, for example, by examining the DS byte or ToS field associated with the typical IP header. Packets with lower QoS requirements, for example, may be relegated to lower priority queues. In contrast, packets with higher levels of QoS, such as real time packets associated with, for example voice data, may be associated with higher levels of time sensitivity and may accordingly be placed in higher priority queues. Packets with progressively greater degrees of time sensitivity may be scheduled in progressively higher priority queues with the highest sensitivity packets being scheduled to high time sensitivity queue D.sub.1 514. Packets having QoS set to Best Efforts, which are usually packets associated with non-real time data may be placed in Best Efforts queue D.sub.N 511, which as the name suggests, are sent when possible, for example, during intervals when there are no higher priority packets to be sent. It should be noted that interleaving and fragmentation may be used in conjunction with the time sensitive and Best Efforts queuing strategies as described. Processing in the pure IP scheduling embodiment will be described in greater detail hereinafter.

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L3: Entry 3 of 5 File: USPT Apr 15, 2003

DOCUMENT-IDENTIFIER: US 6549938 B1
TITLE: System and method for prioritizing multicast packets in a network service class utilizing a priority-based quality of service

Abstract Text (1):
A system and method for achieving a comparable quality of service for each of the receivers of a multicast transmission incorporating a priority-based quality of service is provided. Packet acceptance criteria established at each individual connection of a network node is overridden to provide a collective packet acceptance criteria for each packet of a multicast transmission targeted for the individual connections. The packet acceptance criteria is collected from each of the individual connections in the network node that are targeted for the multicast transmission. A multicast packet priority is calculated for each of the packets associated with the multicast transmission based on an aggregate analysis of the packet acceptance criteria of each of the individual connections. Each of the packets associated with the multicast transmission is collectively accepted or discarded based on the calculated multicast packet priority.

Brief Summary Text (2):
The present invention relates generally to network communications systems, and more particularly, to a method and apparatus for providing packet acceptance and rejection determinations on a multi-user basis, for multicast transmissions implementing a priority-based quality of service.

Brief Summary Text (15):
The present invention is applicable in a network service class which incorporates a priority-based quality of service. This service class, hereinafter referred to as the Simple Integrated Media Access (SIMA) service class, provides a network management architecture that is simple in concept and in its implementation, yet adequately addresses the quality of service requirements to support a variety of network services, including real-time and non-real-time services. It also provides for the implementation of a simple and effective charging capability that accounts for the use of network services.

Brief Summary Text (16):
However, with the use of such a priority-based quality of service scheme, all packets are handled separately, such that each incoming packet to a core network node is individually analyzed for its priority, or alternatively, its drop preference. This, as is described more fully below, may be unacceptable in multicast situations.

Brief Summary Text (17):
Multicasting is the transmission of packets from one source to multiple receivers or users. For example, in a video broadcasting application, the server sends the same picture to every client. A problem is that that a priority-based QoS such as implemented in SIMA can lead to quite different quality of service at each of the different branches of the multicast transmission. While this may be acceptable in many situations, there are situations where it is preferable to guarantee a similar quality of service to all receivers of the multicast transmission. For example, a server providing video multicast may want to ensure that all of its clients receive

a video picture that has an approximately constant quality regardless of the location of the receiving user.

Brief Summary Text (18):
Accordingly, there is a need for a system and method for providing packet acceptance and rejection determinations on a multi-user basis, for multicast transmissions implementing a priority-based quality of service. The present invention provides for a similar quality of service for all receivers of the multicast transmission, and therefore overcomes this and other shortcomings of the prior art, and offers additional advantages over the prior art.

Brief Summary Text (20):
The present invention is directed to a system and method for achieving a comparable quality of service for each of the receivers of a multicast transmission incorporating a priority-based quality of service.

Brief Summary Text (24):
In accordance with yet another embodiment of the invention, a system for equalizing the quality of service provided in a priority-based network service class is provided. The system includes a multicast transmission source and a plurality of multicast packet receivers. Within the network is at least one node that coupled the multicast transmission source and the plurality of multicast packet receivers. The node includes a router to route the multicast packets to their corresponding multicast packet receivers via a plurality of connections between the multicast transmission source and the plurality of multicast packet receivers. A plurality of packet scheduling modules are provided, one for each connection at the node. Each packet scheduling module accepts and discards packets based on an allowable packet priority of its corresponding connection. The system further includes a multicast priority management module coupled to each of the plurality of packet scheduling modules to receive the corresponding allowable packet priorities, and to collectively accept and discard the multicast packets destined for the plurality of multicast packet receivers based on an aggregate node priority derived from the allowable packet priorities of each of the packet scheduling modules.

Detailed Description Text (3):
The present invention is directed to a system and method for accepting and discarding multicast transmission packets in a network service class implementing a priority-based quality of service. Each of the core network nodes make multicast packet acceptance decisions prior to delivery of the multicast packets to their individual switched connections. This collective packet acceptance function allows a similar quality of service to be provided for all receivers of the multicast transmission, even where individual connections of the multicast transmission might otherwise be configured to provide a diverse quality of service among the different connections and ultimate users.

Detailed Description Text (4):
A network implemented in accordance with the principles of the present invention provides a priority-based quality of service, such as with the SIMA service class that incorporates a nominal bit rate (NBR). While the multicast method and system according to the present invention may be applicable to different conventional network switching systems, an appreciation of the principles of the invention is best obtained in the context of the following diagrams, in which a SIMA network service class is shown and described in accordance with the present invention.

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L3: Entry 4 of 5 File: USPT Mar 20, 2001

DOCUMENT-IDENTIFIER: US 6205150 B1
TITLE: Method of scheduling higher and lower priority data packets

Brief Summary Text (9):
The problems associated with scheduling tasks in an operating system also occur in multi-user network systems with a plurality of network connections, network devices and data packets. In a network system environment, a data packet is analogous to a task in an operating system. Customers on a network system may have different Customer Premise Equipment ("CPE") (i.e., a computer) with different capabilities, such as the ability to send and receive data packets at various data rates or bandwidth. In a multimedia system, logical multimedia channels are typically used by a network connection to create separate audio, video and data channels. The audio and video channels are typically allocated with predetermined, fixed maximum bandwidth. For example, on a modem connection an audio channel may have a bandwidth of 5,300 bits-per-second (bps) and a video channel may have a bandwidth of 23,500 bps for a multimedia bandwidth of 28,800 bps (i.e., the sum of the two channels). Many network hosts allow customers to subscribe to various Classes-of-Service ("CoS") and Qualities-of-Service (`QoS") to optimize reliability and data transmission speeds. As is known in the art, class-of-service provides a reliable (e.g., error free, in sequence, with no loss of duplication) transport facility independent of the quality-of-service. Class-of-service parameters include maximum downstream data rates, maximum upstream data rates, upstream channel priority, guaranteed minimum data rates, guaranteed maximum data rate and others. Quality-of-service collectively specifies the performance of a network service that a device expects on a network. Quality-of-service parameters include transit delay expected to deliver data to a specific destination, the level of protection from unauthorized monitoring or modification of data, cost for delivery of data, expected residual error probability, the relative priority associated with the data and other parameters. Higher class-of-service and quality-of-service connections transmit higher priority data packets. Thus, various customers on the network system will transmit and receive both high priority and low priority data packets.

Brief Summary Text (13):
As in an operating system, the router must ensure that lower priority data packets are not starved out by higher priority data packets and thus, provide necessary class-of-service and quality-of-service transmission bandwidth for lower priority tasks. Furthermore, individual customers on the network system may have contracted with the network host for a particular class-of-service and quality-of-service. With the methodology of various scheduling methods, a router may schedule higher priority data packets to or from an individual customer such that the customer may actually receive a lower class-of-service or quality-of-service than what the customer subscribed for. Thus, it is desirable to develop scheduling methods to prevent higher types-of-service from starving out transmission requests from customers of lower types-of-service.

Brief Summary Text (16):
The method includes a first network device monitoring a first queue with multiple data packets of varying priorities and determining scheduling priorities or transmission deadlines for data packets in the first queue. The multiple data packets provide various class-of-service and quality-of-service connections. After

a first network device determines the priority of the data packets, the first network device inserts higher priority data packets into a second queue and lower priority data packets into a third queue. The data packets in the second queue are scheduled for transmission using a first scheduling method as higher priority data packets. The data packets in the third queue are scheduled by a second scheduling method with transmission deadlines as lower priority data packets to be executed after the higher priority data packets. Transmission deadlines prevent lower priority data packets from being "starved out" or delayed of transmission bandwidth. "However, lower priority data packets in the third queue are dynamically promoted to the second queue for rescheduling as a high priority data packet once a transmission deadline has expired to ensure that low priority data packets are not starved out of transmission time. Lower priority data packets are transmitted to provide a minimum connection bandwidth. Higher priority data packets are transmitted to provide a contracted class-of-service or quality-of-service. Thus, the first network device dynamically schedules higher priority data packets while ensuring that lower priority data packets will be executed without delaying transmission time.

CLAIMS:

5. The method of claim 1 wherein the priority of a data packet is determined by any of a class-of-service or quality-of-service of a data packet.

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L3: Entry 5 of 5 File: USPT Feb 13, 2001

DOCUMENT-IDENTIFIER: US 6188670 B1
TITLE: Method and system in a data processing system for dynamically controlling transmission of data over a network for end-to-end device flow control

Detailed Description Text (15):
When the level of the receiver's buffer falls to a lower buffer threshold, such as threshold 96 or 100, the receiver will send a control packet to the transmitter to request that packets which include real-time data now be associated with the higher real-time priority level. The control packet the receiver transmits to the transmitter is sent associated with a control priority. Changing the priority level will change the quality of service received for that data stream. The change of quality of service may result in the data packets being sent at a faster rate and/or the variation in the inter-arrival times of the data packets being reduced.

Detailed Description Text (21):
FIG. 6 depicts a high-level flow chart which illustrates the operation of a receiver during a session of real-time data transmission in accordance with the method and system of the present invention. The process starts as depicted at block 220 and then passes to block 222 which illustrates the receiver talking to the sender, or transmitter, to establish a number of priority levels, number of initial frames, and quality of service parameters. Next, block 224 depicts the receiver waiting for the initial packets. Thereafter, block 226 illustrates the receiver processing the received packets and the monitoring of the level of frames in the receiver's frame buffer. This process includes the assembling of packets into frames and the placing of the frames into the frame buffer. When the receiver has received the final packet of real-time data, the process then passes to block 227 which depicts the receiver ending the session and telling the sender that the session is complete. The process then terminates as depicted at block 228.

Detailed Description Text (27):
Referring again to block 256, if a determination is made that the frame buffer is full, the process passes to block 262 which depicts the receiver sending a control packet to the sender to change the quality of service for the priority level. The process passes back to block 252.

CLAIMS:

3. The method according to claim 2 further comprising the steps of:

utilizing quality of service parameters to determine if said priority hierarchy should be altered; and

in response to a determination that said priority hierarchy should be altered, said receiver dynamically altering said priority hierarchy of said plurality of priority levels during said transmission, wherein said plurality of packets are transmitted in said altered priority hierarchy.

11. The system according to claim 10 further comprising:

means for utilizing quality of service parameters to determine if said priority

hierarchy should be altered; and

means response to a determination that said priority hierarchy should be altered, for said receiver dynamically altering said priority hierarchy of said plurality of priority levels during said transmission, wherein said plurality of packets are transmitted in said altered priority hierarchy.

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L7: Entry 2 of 5 File: USPT Apr 8, 2003

DOCUMENT-IDENTIFIER: US 6546017 B1
TITLE: Technique for supporting tiers of traffic priority levels in a packet-switched network

Abstract Text (1):
The technique of the present invention provides a simple and efficient solution to the problem of supporting differentiated priority levels within a QoS service class within a packet-switched network. When a bandwidth request is received at the cable modem head end, the service ID of that particular cable modem is identified. From this service ID, the associated static priority value of the requesting modem's service class is determined. The grant scheduler at the CMTS maintains a single queuing structure to temporarily store all differentiated priority bandwidth requests associated with a particular class of service that are received from cable modems on a selected channel. The technique of the present invention implements a procedure to calculate a metric used in determining a queuing priority for each received bandwidth request so that a single priority queuing structure may be used for this purpose. The metric is calculated by subtracting a product of the static priority value from the arrival time value of an associated bandwidth request. Use of the static service class priority in the queuing priority metric helps the grant scheduler to prioritize bandwidth requests from high priority modems over requests from low priority modems in the same queuing structure. Use of the arrival time in the metric enables an implicit fairness feature in the traffic prioritization to prevent starvation of low priority traffic.

Application Filing Date (1):
19990305

Detailed Description Text (2):
The technique of the present invention provides a simple and efficient solution to the problem of supporting tiered or differentiated priority levels within a QoS service class without starvation of lower priority traffic within that service class. The technique of the present invention may be implemented in a variety of packet-switched networks which support a plurality of different service classes. These packet-switched networks include both cable networks and linked networks such as IP networks, LANs, WANs,. etc. For purposes of illustration, the technique of the present invention will be described with respect to bandwidth requests within a cable modem network. However, it is to be understood that the technique of the present invention may be applied to other types of packet-switched networks including IP networks, ATM networks, etc.

Detailed Description Text (11):
Recently, it has been contemplated that HFC cable systems could be used for two-way transmission of digital data. The data may be Internet data, digital audio, or digital video data, in MPEG format, for example, from one or more external sources 100. Using two-way HFC cable systems for transmitting digital data is attractive for a number of reasons. Most notably, they provide upto a thousand times faster transmission of digital data than is presently possible over telephone lines. However, in order for a two-way cable system to provide digital communications, subscribers must be equipped with cable modems, such as cable modem 120. With respect to Internet data, the public telephone network has been used, for the most

part, to access the Internet from remote locations. Through telephone lines, data is typically transmitted at speeds ranging from 2,400 to 33,600 bits per second (bps) using commercial (and widely used) data modems for personal computers. Using a two-way HFC system as shown in FIG. 1 with cable modems, data may be transferred at speeds up to 10 million bps. Table 1 is a comparison of transmission times for transmitting a 500 kilobyte image over the Internet.

Detailed Description Text (23):
Downstream Modulator and Transmitter 206 converts the digital packets to modulated downstream RF frames, such as, for example, MPEG or ATM frames. Data from other services (e.g. television) is added at a combiner 207. Converter 208 converts the modulated RF electrical signals to optical signals that can be received and transmitted by a Fiber Node 210 to the cable modem hub.

Detailed Description Text (35):
Each cable modem in the network is assigned an exclusive service ID which allows the CMTS 204 to identify the particular cable modem associated with a received request on a particular upstream channel [i]. For purposes of simplification, it will be assumed that each cable modem corresponds to a particular subscriber in the cable modem network. In networks where differentiated service classes are supported, each subscriber may choose to pay for a particular grade of service within that service class. Although the technique of the present invention will be described in terms of handling bandwidth requests associated with tiered or differentiated best-effort service, it is to be understood that the technique of the present invention may be applied to any QoS service class having differentiated priority levels within that service class.

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L7: Entry 4 of 5 File: USPT Jan 16, 2001

DOCUMENT-IDENTIFIER: US 6175569 B1
TITLE: Extending asynchronous transfer mode ATM QoS across local area networks

Application Filing Date (1):
19971107

Detailed Description Text (11):
Referring to FIG. 5, the present invention exploits the availability of the frame priority subfield by mapping several of the available priority values to existing ATM QoS connection classes. The highest frame priority value (B`111`) is excluded from the mapping and continues to be used to identify high priority MAC frames. The next lower priority value (B`110`) is used by the local LAN/ATM interface device to send frames from the ATM network to LAN destination stations. The remaining priority values can be mapped directly to existing ATM QoS with successively lower priority values representing successively lower priority ATM QoS. As specific examples, the highest uncommitted priority value (B`101`) is mapped to the ATM CBR connection class while the lowest available priority value is mapped to the ATM UBR class. The preferred mapping is shown in the drawing. It should be noted that two priority values are assigned to the ATM VBR-RT connection class with the higher of the two being dedicated to connections for MPEG-1 class data traffic and the lower being dedicated to connections for MPEG-2 class data traffic. These priority definitions provide the LAN/ATM interface device guaranteed/bounded access to the LAN segment to deliver frames originating across the ATM network.

Detailed Description Text (21):
Up to this point, the description has focussed on the LAN/ATM interface device and relatively littled has been said about the LAN stations that connect to that device. Clearly, any LAN station which is to make use of the invention must include certain basic components. Referring to FIG. 8, any LAN station 104 necessarily includes a processor 106, a memory 108 user input/output (I/O) elements, as well as an integrated or removable LAN adapter 112. Further, a LAN adapter necessarily includes frame generating logic 118 for formatting and generating LAN frames. The frame generating logic must be capable of writing one of the available frame priority values into the frame priority subfield in the physical layer header of the frame. In a basic embodiment, the generated frame would be transmitted to the LAN/ATM interface device, where priority mapping logic in the interface device would map the priority level to a particular ATM QoS as discussed earlier. FIG. 8 shows an alternate embodiment in which the LAN station itself includes explicit priority mapping logic 116. Including the priority mapping logic in the LAN station would permit a user application executing at the LAN station to specifically request a network connection satisfying a particular ATM QoS guarantee. The mapping logic in such a case would map the ATM QoS portion of the request to one of the previously-discussed available frame priority values, creating a standard Token Ring frame with a mapped frame priority value. This frame, when received at the LAN/ATM interface device, would be re-mapped back to a ATM QoS corresponding to that requested by the user application. The LAN/ATM interface device would respond to such a frame as described earlier without knowing or caring that the original connection request actually contained the desired ATM QoS.

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L7: Entry 5 of 5 File: USPT Jun 20, 2000

DOCUMENT-IDENTIFIER: US 6078998 A
TITLE: Real time scheduling of prioritized disk requests

Application Filing Date (1):
19970211

Brief Summary Text (6):
For example, in a block of MPEG-encoded video data stored in the form of a sequence of I, P and B frames, losing an I data block might result in the loss of more display frames than losing a P or B data block. A disk scheduling algorithm that favors the I frames over the P or B frames may result in better quality of service.

Detailed Description Text (10):
Priority of requests can also be based upon other factors, for instance, in the video-on-demand multimedia application a users' perception of the QOS during playback may dictate a priority level. Because a user can perceive delayed/lost frames of audio much more easily than lost frames of video, requests for audio data must be processed at a higher priority than video data.